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(54) Title of the Invention: Liquid Crystal Display Element

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Specification

1. Title of the Invention

Liquid Crystal Display Element

2. Claim

A liquid crystal display element characterized in a liquid crystal display element in which a pair of transparent boards are adhered via a seal member in a frame-like shape mixed with a spacer, an interval between the two boards is sealed with a liquid crystal, the transparent electrodes for display are respectively formed at regions of faces of the two boards surrounded by the seal member and a terminal portion of the transparent electrode of one of the board faces and a terminal portion of the transparent electrode of other of the board faces are respectively led out to board edge portions orthogonal to each other via seal portions adhered by the seal member, wherein a dummy electrode comprising a conductive layer the same as a conductive layer of the terminal portion is provided at a portion of the seal portion to which the terminal portion does not pass therethrough to form on either one of the board faces.

3. Detailed Description of the Invention

[Industrial Field of Application]

The present invention relates to a liquid crystal display element.

[Prior Art]

Conventionally, a liquid crystal display element for displaying a television image or the like is constructed by a constitution as shown by Fig.6 through Fig.8. Further, Fig.6 is a sectional view of a liquid crystal display element, Fig.7 is a view of an electrode pattern of one board face and Fig.8 is a view of an electrode pattern of other board face.

According to the liquid crystal display element, a pair of transparent boards 1, 2 comprising glass or the like are adhered via a seal member 3 in a frame-like shape, liquid crystals LC are sealed between the two boards 1, 2, transparent electrodes 4, 5 for display are respectively formed at regions surrounded by the seal member 3 of the two boards 1, 2 faces, and a terminal portion 4a of the transparent electrode 4 on one board 1 face and a terminal portion 5a of the transparent electrode 5 of other board 2 face are respectively led out to board edge portions orthogonal to each other via seal portions adhered by the seal member 3. Further, the liquid crystal display element is of a simple matrix type, the transparent electrode 4 of one board, for example, the lower board 1 face is made to constitute a scanning electrode in a stripe-like shape as shown by Fig.7, and the transparent electrode 5 of the upper board 2 face is made to constitute a signal electrode in a stripe-like shape as shown by Fig.8 orthogonal to the scanning electrode 4. Further, according to the liquid crystal display element, the respective signal electrode 5 is divided in two at a middle

portion in a length direction thereof as shown in Fig. 8 to thereby divide a display region in two regions, a number of a total of the scanning electrodes are divided in two to thereby enable to drive by multiplex drive, according to the liquid crystal display element, the terminal portion 5a of the signal electrode 5 at one display region and the terminal portion 5a of the signal electrode 5 at other display region are respectively led out to one side edge portion and other side edge portion of the upper board 2, and the terminal portion 4a of the scanning electrode is led out to one end edge portion of the lower board 1. Further, in Fig.7 and Fig.8, notation 3a designates a liquid crystal injecting port formed at a part of the seal member 3 and the liquid crystal injecting port 3a is provided to evade lead-out sides of the terminal portions 4a, 5a. Further, in Fig.6, numerals 6, 7 designate alignment layers respectively formed on faces of the two boards 1,2 for forming the electrodes and the liquid crystals LC sealed between the two boards 1, 2 are aligned by twist alignment between the two boards 1, 2.

Further, there are the liquid crystal display element of a TN type in which the liquid crystals are aligned by twist alignment by a twist angle of substantially 90° and the liquid crystal display element of an STN type in which the liquid crystals LC are aligned by twist alignment by a twist angle

of 180° through 270° in order to improve multiplex driving performance at high duty.

Meanwhile, according to the above-described liquid crystal display element, in order to make a layer thickness of the liquid crystal layer uniform over a total of the display region, in integrating the liquid crystal display element, it is necessary to adhere the two boards 1, 2 such that a clearance(cell gap)therebetween becomes uniform.

Therefore, in the liquid crystal display element, a pertinent amount of a spacer 8 of a granular spacer having a constant particle size or a glass fiber or the like having a constant diameter is mixed in the seal member 3 for adhering the two boards 1,2 and the clearance between the two boards 1, 2 is specified by the spacer 8 as shown in Fig. 6.

[Problems that the invention is to Solve]

However, according to the conventional liquid crystal display element, there poses a problem that the clearance between the two boards 1, 2 specified by the granular spacer 8 in the seal member 3 differs between sides of leading out the terminal portions 4a, 5a of the scanning electrode 4 and the signal electrode 5 and a side at which the terminal portions 4a, 5a are not led out (side formed with the liquid crystal injecting port 3a at the seal member 3).

That is, according to the conventional liquid crystal display element shown by Fig.6 through Fig.7, in the seal portion

for adhering the two boards 1, 2 by the seal member 3, the clearance between the two boards 1, 2 at the seal portion in correspondence with the one end edge side of the liquid crystal display element, is specified by the thickness of the scanning electrode terminal portion 4a passing through the seal portion and the diameter of the spacer 8, the clearance between the two boards 1, 2 at the seal portion in correspondence with the two side edge sides of the liquid crystal display element is specified by the thickness of the signal electrode terminal portion 5a passing through the seal portion and the diameter of the spacer 8 and therefore, when the diameter of the spacer 8 is constant and the thicknesses of the terminal portions 4a, 5a of the scanning electrode 4 and the signal electrode 5 are the same, the clearances between the two boards 1, 2 of the seal portions in correspondence with the one end edge side and the two side edge portions of the liquid crystal display element become equal. However, according to the conventional liquid crystal display element, neither of the terminal portions of the scanning electrode 4 and signal electrode 5 passes through the seal portion in correspondence with other end edge side and therefore, the clearance between the two boards 1, 2 at the seal portion is specified only by the diameter of the spacer 8 and therefore, the clearance between the two boards 1, 2 on this side becomes smaller by an amount of the thickness to the terminal portion 4a, 5a of the scanning electrode 4 and the signal electrode

5. Further, although in Fig.6, since the two boards 1, 2 are illustrated linearly for convenience of drawing, on the other end edge side (left side of drawing) of the liquid crystal display element, the board 1, 2 faces are separated from the spacer 3 in the seal member 3, the two boards 1, 2 are adhered by the seal member 3 by pressing the two boards 1, 2 until the two board 1, 2 faces are brought into contact with the spacer 8 in the seal member 3 at all the periphery of the seal portion and therefore, actually, the two boards 1, 2 are brought into contact with the spacer 8 also at the other end edge side of the liquid crystal display element.

Therefore, according to the conventional liquid crystal display element, the layer thickness of the liquid crystal layer cannot be made uniform over the total of the display region, which constitutes a factor of bringing about 'nonuniformity in display'. This is particularly remarkable in the STN type liquid crystal display element, according to the STN type liquid crystal display element, 'nonuniformity' of the liquid crystal layer thickness significantly influences on the display quality and therefore, occurrence of 'nonuniformity of display' significantly emerges. Further, although in Fig.6, the terminal portion 4a of the scanning electrode 4 is illustrated by a thickness the same as that of the electrode portion, it is normal that the terminal portions 4a, 5a of the scanning electrode 4 and signal electrode 5 each is constituted by a

two-layers structure laminated with a layer of a metal of chromium or the like on a transparent conductive layer (ITO layer or the like) the same as that of the electrode portion in order to improve conductivity thereof and in this case, a thickness of the terminal portion 4a, 5a(layer thicknesses of transparent conductive layer and metal layer) becomes several thousands Angstrom and therefore, the 'nonuniformity' of the clearance between the two boards 1, 2 is considerably increased.

The invention has been carried out in view of the above-described actual situation and it is an object thereof to provide a liquid crystal display element capable of making a layer thickness of a liquid crystal layer uniform over a total of a display region by making a clearance between two boards on a side at which a terminal portion is not led out the same as a clearance on a side of leading out the terminal portion.

[Means for Solving the Problems]

The invention is characterized in a liquid crystal display element in which a pair of transparent boards are adhered via a seal member in a frame-like shape mixed with a spacer, an interval between the two boards is sealed with a liquid crystal, the transparent electrodes for display are respectively formed at regions of faces of the two boards surrounded by the seal member and a terminal portion of the transparent electrode of one of the board faces and a terminal portion of the transparent

electrode of other of the board faces are respectively led out to board edge portions orthogonal to each other via seal portions adhered by the seal member, wherein a dummy electrode comprising a conductive layer the same as a conductive layer of the terminal portion is provided at a portion of the seal portion to which the terminal portion does not pass therethrough to form on either one of the board faces.

[Operation]

That is, according to the invention, by providing the dummy electrode at the portion of the seal portion adhered by the seal member of the two boards at which the terminal portion does not pass therethrough, the clearance between the two boards at the portion is specified by a thickness of the dummy electrode and a diameter of the spacer in the seal member, when the dummy electrode is formed by the conductive film the same as that of the terminal portion, the thickness of the dummy electrode and a thickness of the terminal portion are equal to each other and therefore, the clearance between the two boards on the side at which the terminal portion is not led out is the same as a clearance at the side at which the terminal portion is led out, that is, a clearance specified by the thickness of the terminal portion and the diameter of the spacer in the seal member.

[Embodiment]

An explanation will be given of an embodiment of the invention in reference to Fig.1 through Fig.5 as follows.

Fig.1 is a sectional view of a liquid crystal display element, Fig.2 is a view of an electrode pattern of one board face, Fig.3 is a view of an electrode pattern of other board face, and Fig.4 and Fig.5 are enlarged views of IV portion and V portion of Fig.2. Further, in Fig.1 through Fig.5, portions having constitutions the same as those of the conventional liquid crystal display element shown in Fig.6 through Fig.8 are attached with the same notations in the drawings and an explanation thereof will be omitted.

According to the embodiment, in the liquid crystal display element in which the pair of transparent boards 1, 2 are adhered via the seal member 3 in the frame-like shape mixed with the spacer 8, the liquid crystals LC are sealed between the two boards 1, 2, the scanning electrode 4 and the signal electrode 5 are respectively formed at regions of the two board 1, 2 faces surrounded by the seal member 3, further, the terminal portion 4a of the scanning electrode 4 of the lower board 1 face and the terminal portion 5a of the signal electrode 5 of the upper board 2 face are respectively led out to the board edge portions orthogonal to each other via the seal portions adhered by the seal member 3, a dummy electrode 9 is provided at portions of the seal portion at which the terminal portions 4a, 5a do not pass therethrough.

The dummy electrode 9 is formed by the conductive film the same as that of the terminal portions 4a, 5a on either one of the boards, for example, the lower board 1 face formed with the scanning electrode 4, for example, when the terminal portions 4a, 5a are formed only by transparent conductive layers of ITO or the like, the dummy electrode 9 is also formed only by the transparent conductive layer, when the terminal portions 4a, 5a are constituted by a two-layers structure laminated with a layer of a metal of chromium or the like on the transparent conductive film, the dummy electrode 9 is constituted two layers of layers of the transparent conductive film and the metal film. Further, according to the embodiment, the dummy electrode 9 is constituted by a small piece electrode having a width the same as that of the terminal portion 4a of the respective scanning electrode 4 and a shape symmetric therewith and the dummy electrodes 9 of a number the same as a number of the scanning electrodes are aligned along the seal portion with an aligning pitch the same as that of the terminal portions 4a of the respective scanning electrodes 4. Further, a length of the respective dummy electrode 9 in a direction of a width of the seal portion is constituted by a length substantially the same as the width of the seal member 3(in the drawings, a length slightly larger than the width of the seal member 3)and the respective dummy electrode 9 and an end portion of the respective

scanning electrode 4 are opposed to each other with a small clearance therebetween.

Meanwhile, the spacers 8 mixed in the seal member 3 are distributed substantially uniformly over an entire region of the seal member 3(refer to Fig.4 and Fig.5) and therefore, the spacers 8 in the seal member 3 are substantially uniformly present at a portion of the seal portion at which the scanning electrode terminal portion 4a and the signal electrode terminal portion 5a pass therethrough as well as a portion thereof provided with the dummy electrodes 9.

Further, according to the liquid crystal display element, in the seal portion, the clearance between the two boards 1, 2 at the seal portion in correspondence with the one end edge side of the liquid crystal display element is specified by the thickness of the scanning electrode terminal portion 4a passing the seal portion and the diameter of the spacer 8, the clearance between the two boards 1, 2 at the seal portion in correspondence with the two side edge portions of the liquid crystal display element is specified by the thickness of the signal electrode terminal portion 5a passing the seal portion and the diameter of the spacer 8, and a clearance between the two boards 1, 2 at the seal portion at which neither of the terminal portions of the scanning electrode 4 and the signal electrode 5 pass therethrough (seal portion on the other end edge side of the liquid crystal display element), is specified by the thickness

of the dummy electrode 9 and the diameter of the spacer 8. Therefore, when the diameter of the spacer 8 is constant and all of the thicknesses of the terminal portions 4a, 5a of the scanning electrode 4 and the signal electrode 5 and the dummy electrode 9 the same, the clearance between the two boards 1, 2 becomes equal over the entire region of the seal portion.

That is, according to the liquid crystal display element of the embodiment, by providing the dummy electrode 9 at a portion of the seal portion adhered by the seal member 3 of the two boards 1, 2, at which the terminal portions 4a, 5a of the scanning electrode 4 and the signal electrode 5 do not pass therethrough, the clearance between the two boards 1, 2 at the portion is specified by the thickness of the dummy electrode 9 and the diameter of the spacer 8 in the seal member 3, when the dummy electrode 9 is formed by the conductive layer the same as that of the terminal portion 4a, 5a, since the thicknesses of the dummy electrodes 9 and the terminal portions 4a, 5a are equal, the clearance between the two boards 1, 2 at the side at which the terminal portions 4a, 5a are not led out, becomes equal to the clearance at the side of leading out the terminal portions 4a, 5a, that is, the clearance specified by the thickness of the terminal portion 4a or 5a and the diameter of the spacer 8 in the seal member 3.

Therefore, according to the liquid crystal display element, by making the clearance between the two boards 1, 2

on the side at which the terminal portions 4a, 5a are not led out the same as the clearance at the side of leading out the terminal portions 4a, 5a, the layer thickness of the liquid crystal layer can be made uniform over a total of the display region and therefore, display of high quality without 'nonuniformity of display' can be achieved.

Further, although according to the above-described embodiment, the dummy electrode 9 is constituted by the small piece electrode having the width the same as that of the terminal portion 4a of the respective scanning electrode 4 and the shape symmetric therewith and the dummy electrodes 9 are aligned by the aligning pitch the same as that of the terminal portions 4a of the respective scanning electrodes 4, the dummy electrode 9 may be constituted by an electrode in a strip-like shape along the seal portion, further, the dummy electrode 9 may be formed on the side of the upper board 2 formed with the signal electrode 5 instead of forming the dummy electrode 9 at the lower board 1 formed with the scanning electrode 4. Further, the invention is not limited to the liquid crystal display element dividing the display region by two regions by dividing the respective signal electrode 5 in two at the middle portion in the length direction but applicable to a liquid crystal display element in which the respective signal electrode 5 is constituted by an electrode over a total length of the display region and a terminal portion at one end thereof is led out to a board edge

portion through a seal portion and in that case, dummy electrodes each comprising a conductive film the same as that of the terminal portion may be provided at a seal portion on a side in which a terminal portion of a scanning electrode is not led out and a seal portion on a side at which a terminal portion of a signal electrode is not led out respectively to form on either one of board faces. Further, although the liquid crystal display element of the above-described embodiment is of the simple matrix type, the invention is applicable also to a liquid crystal display element of a TFT active matrix type and applicable to a color liquid crystal display element for displaying a full color image by providing color filters of three colors of red, green, blue.

[Effect of the Invention]

According to the liquid crystal display element of the invention, in the seal portion adhered by the seal member of the two boards, by providing the dummy electrode comprising the conductive layer the same as that of the terminal portion at the portion at which the terminal portion does not pass therethrough, the clearance between the two boards at the portion is specified by the thickness of the dummy electrode and the diameter of the spacer in the seal member and therefore, by making the clearance between the two boards at the side at which the terminal portion is not led out the same as the clearance at the side of leading out the terminal portion, the layer

thickness of the liquid crystal layer can be made uniform over the total of the display region.

4. Brief Description of the Drawings

Fig.1 through Fig.5 show an embodiment of the invention, Fig.1 is the sectional view of a liquid crystal display element, Fig.2 is a view of an electrode pattern of one board face, Fig.3 is a view of an electrode pattern of other board face and Fig.4 and Fig.5 are enlarged views of IV portion and V portion of Fig.2. Fig.6 is a sectional view of a conventional liquid crystal display element and Fig.7 and Fig.8 are views of electrode patterns of two board faces of the conventional liquid crystal display element.

1, 2... boards, 3... seal member, 3a... liquid crystal injecting port, 4... scanning electrode (transparent electrode), 4a... terminal portion, 5... signal electrode (transparent electrode), 5a... terminal portion, 6, 7... alingnment layers, LC... liquid crystal, 8... spacer, 9... dummy electrode

Fig. 1

3 Seal member

5 Signal electrode

2 Board

4a Terminal portion

9 Dummy electrode

8 Spacer

4 Scanning electrode

LC liquid crystal

1 Board

い部分に前記端子部と同じ導電膜からなるダミー電極を設けることにより、この部分の両基板間の間隔を、前記ダミー電極の厚さとシール材中のスペーサの径とによって規制するようにしたものであるから、端子部が導出されていない側における両基板間の間隔も端子部が導出されている側の間隔と同じにして、液晶層の層厚を表示領域全体にわたって均一にすることができる。

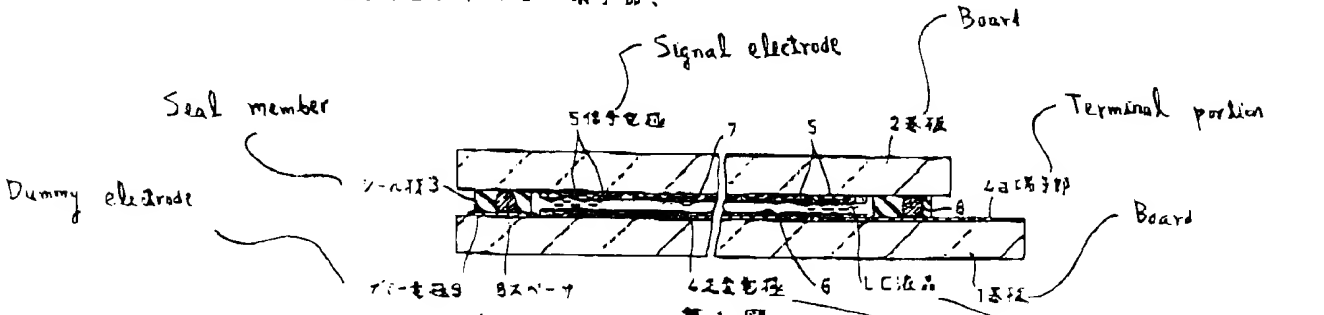
4．図面の簡単な説明

第1図～第5図は本発明の一実施例を示したもので、第1図は液晶表示素子の断面図、第2図は一方の基板面の電極パターン図、第3図は他方の基板面の電極パターン図、第4図および第5図は第2図のIV部およびV部の拡大図である。第6図は従来の液晶表示素子の断面図、第7図および第8図は従来の液晶表示素子の両基板面の電極パターン図である。

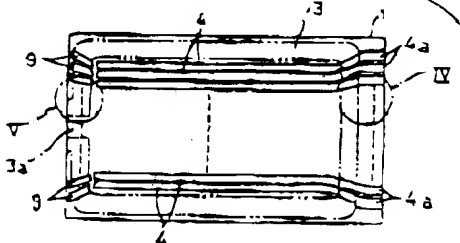
~~4．図面の簡単な説明~~

1，2…基板、3…シール材、3a…液晶注入口、4…走査電極（透明電極）、4a…端子部、5…信号電極（透明電極）、5a…端子部、6，7…配向膜、8…液晶、8…スペーサ、9…ダミー電極。

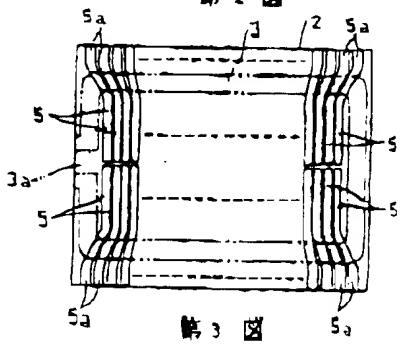
出願人代理人　弁理士　鈴江武彦



第1図



第2図



第3図